

# ***Building smart houses***

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An Englishman's home is his castle

An Englishman's home is his castle computer

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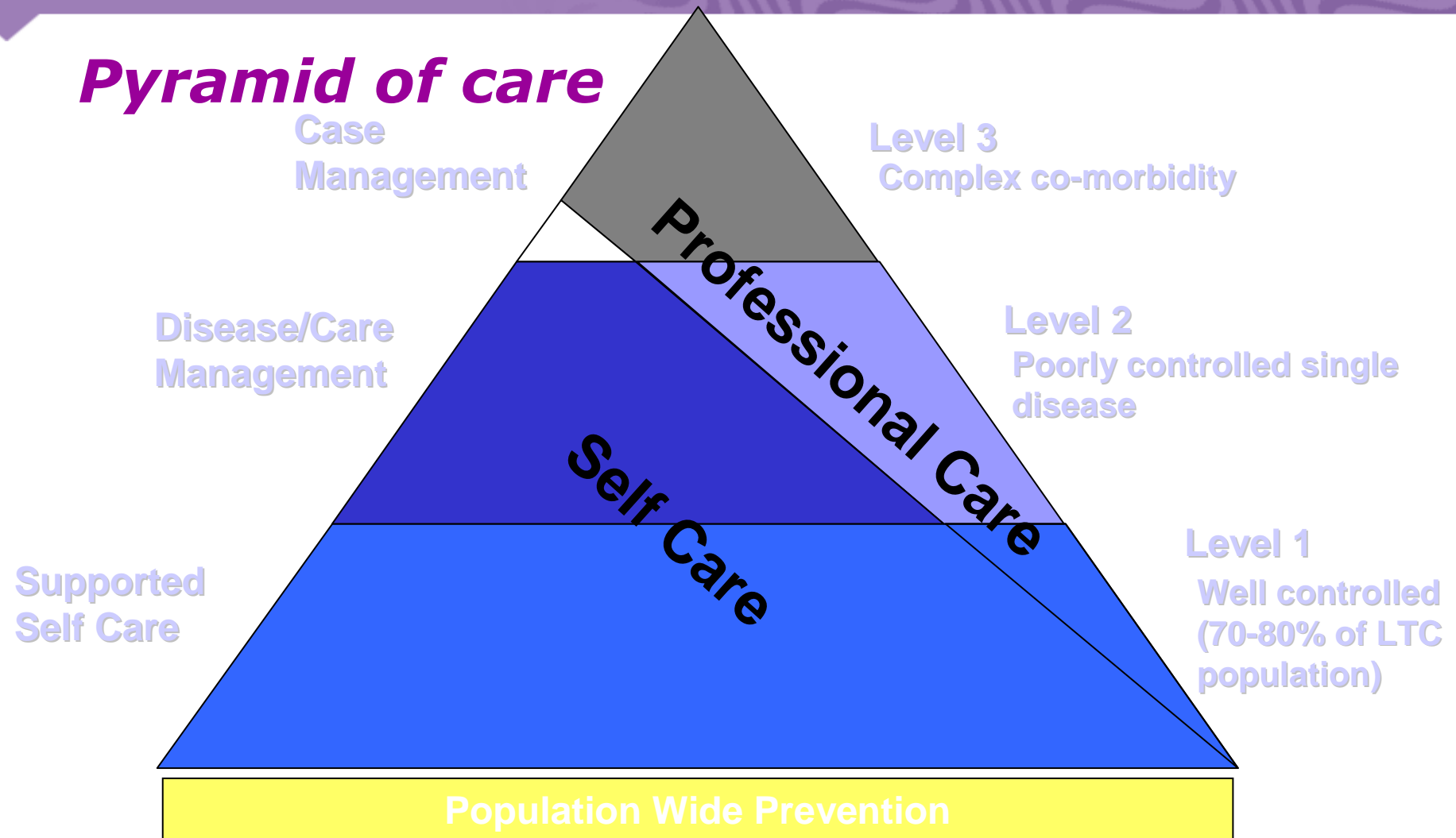
- Introduction
- Home technology
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- What health/care problems can we help?
- Integration between home and other systems
- Challenges
- Summary

## ***Introduction***

- **Why homes?**
  - No room at the inn
    - Demographic pressures placing demands on NHS and social care
    - Health budget cannot grow infinitely
  - People *need* to take more responsibility for their own (or the people they care for's) health and wellbeing
  - People *want* to live at home for longer
- **Why smart?**
  - Technology has many of the answers



## ***Pyramid of care***



## *Introduction*

- Why University of Portsmouth?
  - Working in telemedicine/telecare/e-health since 1998
  - Early surveys
  - More recent evaluation work
  - More recent R&D projects
  - "Digital Wellbeing"
  - Living Lab: Monitoring people in their homes
  - An integrated service platform for the home
    - with PassivSystems Ltd (Newbury)



## *Homes already have a lot of tech*





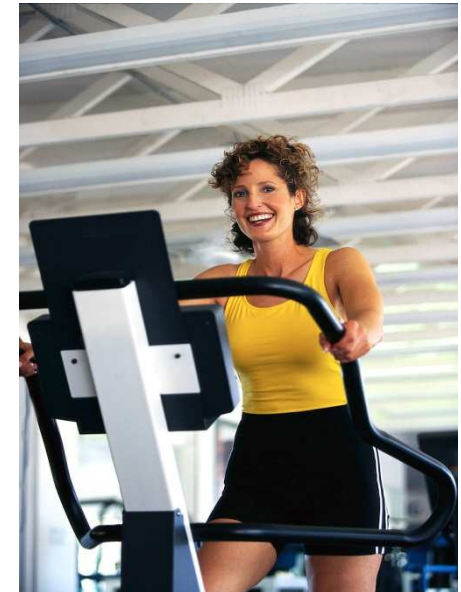
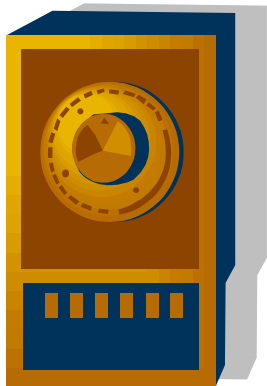
## *Homes already have a lot of tech*

- Entertainment
  - Often centred around TV
    - satellite and cable are new routes into the home
    - the "remote control" as "simple" interaction device
  - Music anywhere
  - Games on various platforms
- Communications
  - Portable phones; mobile phones; smart phones
- Computing
  - Often integrating the above
  - Also big for education

## *Homes already have a lot of tech*

- Alarm systems
  - First application of sensors
    - doors, PIRs, smoke detectors, etc.
  - Cameras
- Kitchen
  - Timers: oven, microwave
  - White goods slowly getting smarter

## *Homes are getting more tech*



## *Homes are getting more tech*

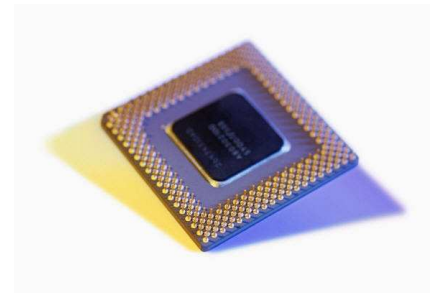
- Energy management
  - Heating: boiler, thermostat
  - Monitoring consumption of electricity, gas, water
  - Remote control of heating and lighting
- Health and fitness
  - Health monitoring: blood pressure, blood glucose, etc.
  - Fitness: exercise bikes
  - Most are self-prescribed

## *Existing tech getting joined up*

- TV and Internet
  - sources of information
  - controlling set-top boxes remotely
- Communications
  - Accessing email/web/social media on both fixed and mobile devices

## *Technology advances: trends*

- Everything:
  - is smaller
  - is faster
  - stores more data
  - is connected
  - is easier to use
  - is nicer to look at
  - is cheaper



## ***Technology advances: applications***

- Development and reduced cost of mobile devices
  - portability = convenience
- Wide availability and low cost of mobile networking
  - Bluetooth/ZigBee, Wi-Fi, 3G phone networks
- Ease of installing wireless devices in the home
  - no wires
- Ubiquity of web-based apps as a user interface
  - on computers and portable devices
- Richer information
  - multimedia: images used where once only had text
  - detail: complete record where once only had summaries
  - sharing: reduced cost of networking and data storage means more data can be shared in more places



## *Technology advances: applications*

- **Sensors**
  - home devices
  - wearable devices
  - devices that measure things that previously couldn't be measured
  - devices that can measure more accurately, more frequently, more conveniently, at less cost
- **Miniaturisation**
  - data can be collected in new ways ...
  - ... and new places
  - less obvious / more comfort



## ***Non-technology advances***

- Design
  - Aesthetics of devices
- More marketing
  - Partly due to people's increasing {familiarity / ability / willingness} to use technology
  - Partly due to demands on providers to invest in technology
  - Partly due to globalisation of markets

## ***Sensors***

- Environmental sensors
  - temperature, humidity
- Emergency sensors
  - smoke, CO<sub>2</sub>, flood
- Security sensors
  - door open, passive infra-red
- User-operated "sensors"
  - buttons on pendants, wristbands
- Energy sensors
  - mains, household circuits, specific devices

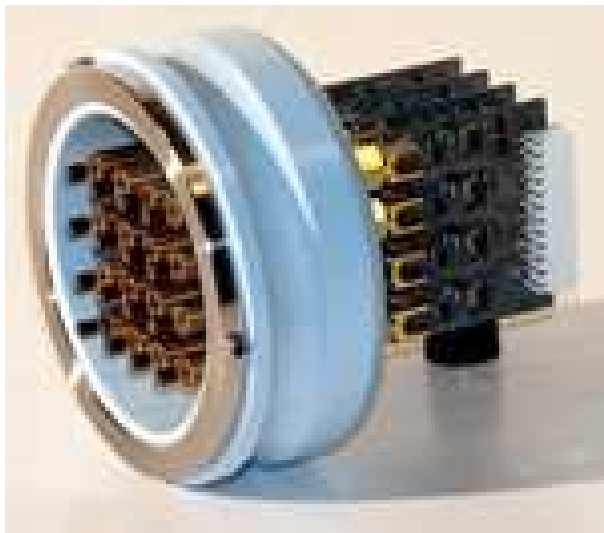
## ***Sensors***

- **Health sensors**
  - blood pressure, blood glucose, body temperature, lung capacity, ECG, pedometer
- **Care sensors**
  - pressure mats, bed mats, medicine dispenser
- **RFID**
  - to identify (and locate) everything
- **Information sources**
  - fridge, shopping list

## *Laerdal BedAlert*



## *Electrical potential sensors (ECG)*



University of Sussex

## *Future sensors*



## ***How can smart homes help people?***

- Support
- Treatment
  - also management of chronic conditions
- Diagnosis
- Prevention

## ***Who/what can we support?***

- Specific conditions
  - Falls management
  - Mild dementia
  - Hospital discharge
  - Chronic condition
  - Stroke recovery
- Specific groups
  - Elderly
  - Mental health
  - Physical disability
  - Learning disability
  - Substance abusers
  - Socially isolated
  - Geographically isolated



## ***What can smart homes add?***

- Not much
  - just sense more things
  - integrate with other systems
  - make some things easier
- Ordinary, fit people
  - Wellbeing

## ***Integrating home and other systems***

- Access home systems remotely
  - alter central heating from the office/mobile
- Carer access to monitoring
  - website linked to home sensors

## *Pipe dreams?*

- Remote doctor visits
  - save GP from travel; use local equipment
- Talking house
  - provides advice and support for daily activities
- Healthy house
  - monitors health, lifestyle and activities
- Home surgery
  - conduct simple medical procedures remotely

## *Issues 1*

- Integrating data
  - common means of identifying people
  - provenance (quality) of data
    - accuracy
    - confidence levels
    - context
  - quantity of data is always going to be an issue
  - much data is redundant but you don't know which
  - timeliness (for diagnosis or prevention)
  - centralisation (logically yes, but often physically no)

## *Issues 2*

- Confidentiality and privacy
  - spectre of Big Brother
- Convenience or expediency often trumps security
  - in which case, obtaining consent is meaningless
  - Tesco clubcard
- Many people assume that their healthcare records are already integrated

## *Challenge*

Not about the technology

It's about engineering services  
to ensure that the right (quality) information  
is collected, gets to and is used in  
the right place at the right time

## *Summary*

- Technology making things smaller and cheaper
- Demographic and economic trends driving need for new solutions
- Increasing (user and practitioner) experience of home technology
- New applications continually being developed
- Integration and privacy are challenges

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